

Serial No.: 09/682,978

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

*AF &  
LZW*

*In re Patent Application of:*

Docket No.: BUR920010077US1

Kellie L. DUTRA, *et. al.*

Serial No.: 09/682,978

Group Art Unit: 1765

Filed: November 5, 2001

Examiner: VINH, Lan

Confirmation No.: 4144

For: **METHOD OF STABILIZING OXIDE  
ETCH AND CHAMBER  
PERFORMANCE USING SEASONING**

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P.O. Box 1450  
Alexandria, VA 22313-1450

**APPEAL BRIEF UNDER 37 C.F.R. § 41.37(a)**

Sir:

Appellants have filed a timely Notice of Appeal from the Final Office Action, on August 20, 2004. A single copy of this brief is provided pursuant to 35 U.S.C. § 41.37(a).

Appellants herein petition for a one (1) month extension of time under 35 U.S.C. § 1.136(a)(1). A check in the amount of \$110.00 is attached hereto to cover the fee for the one month extension of time. Please charge International Business Machine Corporation's Deposit Account No. 09-0456 (Essex Junction) in the amount of \$340.00 (37 C.F.R. § 41.20 (b)(2)) to cover the fee for filing this appeal brief. If additional extensions of time are necessary, then such extensions of time are hereby petitioned under 37 C.F.R. § 1.136(a), and any fees required therefor (including any additional fees for filing of the Appeal Brief) are hereby authorized to be charged, or overpayment credited, to IBM Deposit Account 09-0456 (Essex Junction).

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### **REAL PARTY IN INTEREST**

The real party in interest in this appeal is International Business Machine Corporation, assignee of the entire interest in the above-identified application.

### **RELATED APPEALS AND INTERFERENCES**

The Appellants, their legal representatives and the Assignee are not currently aware of any appeal that may directly affect or be indirectly affected by or have some bearing on the Board's decision in this appeal. Attached hereto is a Related Proceedings Appendix showing no related appeals or interferences.

### **STATUS OF THE CLAIMS**

Claims 1 - 26 are currently pending.

Claims 1 - 26 are currently rejected.

Claims 1 - 26 and are the subject of this appeal.

No claims have been withdrawn, cancelled, or allowed. The claims in issue are attached in the "Claims Appendix" attached herewith.

### **STATUS OF AMENDMENTS**

All prior amendments to the application have been entered.

## **SUMMARY OF CLAIMED SUBJECT MATTER**

### ***Independent Claim 1***

The invention recited by claim 1 is directed to a semiconductor production reactor comprising at least one interior chamber surface. *See* Specification, p. 5, lns. 9-11. The at least one interior chamber surface comprises a first material and a substance incorporated in the first material. *Id.* at, p. 7, lns. 11-15; p. 8, ln. 1. Additionally, the substance balances receipt of a to-be-controlled material. *Id.* at p. 8, lns. 1-7 and p. 7, lns. 13-15.

### ***Independent Claim 13***

The invention recited by claim 13 is directed to a method of seasoning a reactor chamber. *Id.* at p. 5, lns. 13-14. The method comprises providing a reactor chamber having at least one interior surface that comprises a first material (*Id.* at p. 7, lns. 17-26) and incorporating a substance in the first material of the interior surface of the reactor chamber. *Id.* at p. 7, lns. 13-15. The substance comprises a seasoning element, or compound containing seasoning atoms or molecules that, when combined with the chamber surface and/or a material to be used in the reactor chamber, are relatively less volatile than a combination, alone without the seasoning atoms or molecules, of the chamber surface and the material to be used in the reactor chamber. *Id.* at p.8, lns. 26-30.

### ***Independent Claim 24***

The invention recited by claim 24 is directed to a method of controlling fluorine in production processes in a reactor. *Id.* at p. 6, lns. 1-8. The method comprises incorporating a substance in a first material of an interior surface of the reactor's reaction

chamber (*Id.* at p. 7, lns. 11-13), and conducting a production process in the reactor in which fluorine is present in the reaction chamber. *Id.* at p. 10, lns. 11-13; p. 10, lns. 21-34 to p. 11, lns. 1-13. The substance comprises seasoning atoms that reduce the formation of volatile compounds and complexes when fluorine encounters the interior surface of the reactor's reaction chamber. *Id.* at p. 9, lns. 27- 34 to p.10, lns. 1-19.

**GROUNDS OF REJECTION TO BE  
REVIEWED ON APPEAL**

1. Claims 1-7, 9, 11, 13-14, 16-20, and 22-26 stand rejected under 35 U.S.C. §102(e) as being anticipated by U.S. Patent No. 6,444,037 to Frankel, *et al.* ("Frankel").
2. Claim 8 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Frankel in view of U.S. Patent No. 6,508,911 to Han, *et al.* ("Han").
3. Claims 10, 12, 15, and 21 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Frankel in view of U.S. Patent No. 5,997,685 to Radhamohan, *et al.* ("Radhamohan").

## ARGUMENT

### ***REJECTION UNDER 35 U.S.C. 102(e)<sup>1</sup>***

#### ***Claims 1-7, 9, and 11***

Appellants appeal this rejection, which is premised on the Examiner's argument that the claimed apparatus is indistinguishable from the apparatus described by Frankel and that various features in the claims are to be given no patentable weight. *See* p. 2, para. 2, lns. 2-13 to p. 3, lns. 1-5 of the Final Office Action (FOA) dated June 4, 2004. *See also* p. 3, lns. 14-16 and p. 4, lns. 11-15 of the Advisory Action (AA) of July 15, 2004. Appellants respectfully traverse this argument and submit not only that the various features in the claims are to be given patentable weight, but also that the claimed invention is distinct from that disclosed by Frankel.

Regarding claims 1-7, and 9, the Examiner gives no patentable weight to the following phrases:

- a) "the substance balances receipt of a to-be-controlled material" (Claim 1);
- b) "wherein the interior chamber surface minimizes volatile compound or complex formation upon a to-be-controlled material contacting the interior chamber surface" (Claim 2);
- c) "wherein the surface blocks an etching material" (Claim 3);
- d) "wherein the substance binds with silicon and minimizes Si-F bonding" (Claim 5);

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<sup>1</sup> Elements of the Examiner's rejection that are common to this entire claim grouping are briefly addressed as follows. However, one or more of claims 1-7, 9, and 11 are also argued on their own merits, below.

- e) "wherein the substance minimizes formation of a volatile compound or complex" (Claim 6);
- f) "wherein the substance minimizes SiF<sub>4</sub> formation" (Claim 7); and
- g) "wherein the substance impedes reaction between the chamber surface and the to-be-controlled material" (Claim 9).

The Examiner argues that phrases a) – g) are not entitled to patentable weight because they are statements of intended use that do not structurally distinguish over the prior art. *See* pgs. 2-3, para. 2, lns. 8-21 of the Final Office Action mailed June 6, 2004. For support, this conclusion incorrectly relies on MPEP § 2111.03, which deals with transitional phrases of a claim such as "comprising", "consisting of" and "consisting essentially of". For example, MPEP § 2111.03 specifically states:

The transitional phrases "comprising", "consisting essentially of" and "consisting of" define the scope of a claim with respect to what unrecited additional components or steps, if any, are excluded from the scope of the claim.  
*See* Manual of Patent Examining Procedure (MPEP) § 2111.03 (8th Ed., Rev. Feb. 2003)

Despite the Examiner's arguments, the phrase "a substance incorporated in the first material," and the qualifying clause "the substance balances receipt of a to-be-controlled material," both follow after the transitional phrase "comprising". Because words that precede the term "comprising" are considered part of the claim's preamble, and words that succeed the term "comprising" are be considered part of the claim's body, the qualifying clause "the substance balances receipt of a to-be-controlled material" is as much a part of the body of the claim as the phrase "a substance incorporated in the first

material”, and the remaining claim features. As part of the body of the claim, the qualifying clause is entitled to be given patentable weight. Consequently, it appears the Examiner has either improperly referenced the MPEP or has improperly applied this section to the body of the claim where the disputed language resides (e.g., “the substance balances receipt of a to-be-controlled material.”)

The Examiner also argued that the qualifying clause “the substance balances receipt of a to-be-controlled material” is a statement of intended use (FOA, p. 3, lns. 2-7), when in fact the disputed language recites a functional limitation that explains and/or describes properties of various claim elements and limits their scope. For example, MPEP § 2106 clearly states:

The subject matter of a properly construed claim is defined by the terms that limit its scope. It is this subject matter that must be examined. As a general matter, the grammar and intended meaning of terms used in a claim will dictate whether the language limits the claim scope. Language that suggests or makes optional but does not require steps to be performed or does not limit a claim to a particular structure does not limit the scope of a claim or claim limitation. The following are examples of language that may raise a question as to the limiting effect of the language in a claim: (A) statements of intended use or field of use, (B) “adapted to” or “adapted for” clauses, (C) “wherein” clauses, or (D) “whereby” clauses.

Clearly, the claimed invention does not use any “adapted to”, “adapted for”, “wherein” or “whereby” clauses. For this reason, the Examiner’s attempted application of MPEP 2106 appears to be inapplicable. Also, Appellants have repeatedly indicated that none of the language in the claims is language that states or indicates either an intended use or a field of use. Additionally, Appellants have repeatedly submitted that all of the claim language makes up the limitations recited therein.

In view of the foregoing and contrary to the Examiner's assertions, the combination of various elements recited in claims 1-7, 9 and 11 does not use language that suggests or makes optional. Rather, the disputed claim language includes limitations (a substance implanted in a first material...) that patentably distinguish over the cited reference. Because the claim language itself does not recite an intended use, the claim language should be given patentable weight.

Additionally, if the Examiner is of the opinion that the terminology used in the claimed invention is an intended use and should not be given patentable weight, MPEP §2111.02 would address this issue. However, MPEP §2111.02 is directed to statements made in the preamble, which is not the situation with regard to the issues presented herein. More specifically, MPEP §2111.02 states, in part

"During examination, statements in the preamble reciting the purpose or intended use of the claimed invention must be evaluated to determine whether the recited purpose or intended use results in a structural difference (or in the case of process claims, manipulative difference) between the claimed invention and the prior art. If so, the limitation serves to limit the claim."

s respectfully traverse the Examiner's argument and respectfully submit that each of the phrases a) – g) is entitled to patentable weight. Each of the phrases a) – g) are statements resulting in structural difference(s) between the claimed invention and the prior art, as explained in more detail below. Accordingly, each of the phrases a) – g) must be given patentable weight.

***Claims 1 and 11***

Claim 1 recites a combination of elements, including, for example:

A semiconductor production reactor comprising . . . at least one interior chamber surface comprising a first material and a substance incorporated in the first material, the substance balances receipt of a to-be-controlled material.

The Examiner argues that “claims 1-7, 9, and 11 are not distinguishable from the cited prior art apparatus which has the same structure as the claimed inventions [sic].” *See p. 3, lns. 15-16 of the Advisory Action mailed July 15, 2004.* Additionally, giving no patentable weight to the phrase, “the substance balances receipt of a to-be-controlled material,” the Examiner further argues that Frankel discloses:

- i) a reaction chamber;
- ii) the chamber has an interior surface;
- iii) the interior chamber surface comprises a first material (e.g., aluminum);  
and
- iv) a fluorine based gas may begin to react with the aluminum chamber wall,  
which reads on a substance incorporated in the first material.

*See p. 2, paragraph 2, lns. 3-7 of the Office Action mailed June 6, 2004.*

Appellants traverse these arguments for several reasons. Appellants submit that the Frankel reference does not teach or suggest the feature of the “the substance balances receipt of a to-be-controlled material.” Frankel also does not show the remaining elements of the claimed invention, in view of the meaning which should be accorded to the claimed invention. Additionally, the features recited by claim 1 result in a structure different than that disclosed by Frankel.

A To-Be-Controlled Material

The Examiner gives no patentable weight to the feature “the substance balances receipt of a to-be-controlled material.” In fact, the Examiner does not even address this feature as being taught in the Frankel reference. The Examiner only address a chamber, a first material and a substance incorporated into the first material. It is Appellants’ position that the feature “the substance balances receipt of a to-be-controlled material” should be given patentable weight, and that the Frankel reference does not even remotely teach or suggest this feature. For this reason, the claimed invention is distinguishable over the Frankel reference.

Misinterpretation of the Claimed Invention

Frankel’s teachings and the Examiner’s interpretations thereof are contrary to the reading of the claimed invention. Frankel discloses introducing fluorine gas into a reaction chamber to react with a residue coated on the chamber’s interior surfaces. *See* col. 38, lns. 35-47. The reaction consumes the residue and creates a gas (e.g., SiF<sub>4</sub>), which is evacuated from the chamber. *Id.* When substantially all of the residue has been consumed, the supply of fluorine gas is shut off to prevent excess fluorine gas from reacting with the aluminum chamber walls to form an aluminum fluoride compound. *Id.* Frankel expressly teaches that implanting fluorine gas into the residue, or the material forming the chamber walls, results in the formation of a new fluoride-based compound, complex, or gas.

With this understanding, the Examiner is of the opinion that Frankel discloses a reaction chamber having an interior surface. This same feature is suggested by the

claimed invention. However, the Examiner then argues that the interior chamber surface comprises a first material (e.g., aluminum) and a fluorine is the substance incorporated into the aluminum chamber wall. But this is not accurate. In Frankel,

... fluorine-based gas is used to react with  $\text{SiO}_2$  powder residue in the chamber to form a  $\text{SiF}_4$  gas, which is drawn out of chamber 15 with the vacuum pump. When substantially all of the  $\text{SiO}_2$  in the chamber has been consumed, the fluorine-based gas cannot react with the  $\text{SiO}_2$  to form  $\text{SiF}_4$ . Instead, the fluorine-based gas may begin to contaminate the chamber 15 or to react with, for example, the aluminum walls of the chamber to form an aluminum fluoride compound. Consequently, it is important to determine the approximate endpoint or the point at which the last  $\text{SiO}_2$  residue has reacted with the fluorine gas so that gate valve 280 can be closed to prevent further fluorine radicals from entering chamber 15.

*See col. 38, lines 40-50.*

In this manner, the detection system of Frankel is used to ensure that the fluorine gas does not react with the aluminum surface of the reaction chamber. If the fluorine gas reacts with the aluminum surface, then aluminum contamination may result. This is contrary to the Examiner's interpretation.

Additionally, with this understanding, it is readily apparent that not only does the fluorine react with the  $\text{SiO}_2$ , it actually creates  $\text{SiF}_4$ . But, according to Appellants' specification and the interpretation of the claims, such a fluoride-based compound, complex, or gas is a "to-be-controlled material." *See* p. 3, lns. 21-25; p. 7, lns. 23-31; p. 9, lns. 1-14. Thus, maximizing creation of a new fluoride-based compound, complex, or gas (e.g.,  $\text{SiF}_4$ ) as taught by Frankel does not "balance receipt of a to-be-controlled material" as claimed. Accordingly, Frankel's disclosure teaches away from the claimed invention.

The Claimed Invention  
Results in A Different Structure

Additionally, the features recited by claim 1 result in a structure different than that disclosed by Frankel. In the claimed invention, incorporation of a substance into the first material produces a reaction chamber having its interior surfaces seasoned with atoms and molecules of the substance. *See* Specification, p. 8, lns. 1-7 and lns. 22-24; and FIG. 1B. These atoms and molecules prevent atoms of a to-be-controlled material from contaminating and/or reacting with the first material. *Id.* at p. 12, lines 1-2. As a result, none or very little of the first material is consumed and/or converted into a gas or compound. *Id.* Thus, the claimed invention yields a reaction chamber surface seasoned with atoms/molecules of a substance that balances receipt of a to-be-controlled material. On the other hand, Frankel's teachings yield either a virtually pure reaction chamber surface clean of residue, or a reaction chamber surface contaminated with aluminum fluoride. Clearly, the limitations of claim 1 result in a structure different from that disclosed by Frankel's teachings.

For at least these reasons, claim 1 is patentable over Frankel. Claim 11 is also patentable over Frankel based on its dependency from allowable claim 1. Accordingly, allowance of claims 1 and 11 is respectfully requested.

***Claims 2 and 6***

Claim 2 recites a combination of elements, including, for example:

...wherein the interior chamber surface minimizes volatile compound or complex formation upon a to-be-controlled material contacting the interior chamber surface.

Claim 6 recites a combination of elements, including, for example:

...wherein the substance minimizes formation of a volatile compound or complex.

Frankel does not disclose or suggest these features.

For example, the claims are to be interpreted in view of the specification. In the specification, SiF<sub>4</sub> gas is described as the volatile compound or complex formed upon fluorine gas contacting an interior chamber surface formed of silicon. *See Specification*, p. 3, lns. 21-25; p. 7, lns. 23-31; p. 9, lns. 1-14. Appellants' specification further discloses that incorporating a substance, such as cobalt, into the interior chamber surface minimizes formation of volatile SiF<sub>4</sub> gas. *Id.* at p. 8, lns. 22-30; FIG. 1B; p. 10, lns. 11-19; p. 11, lns. 2-13.

Frankel's disclosure, on the other hand, expressly teaches its chamber surface residue (SiO<sub>2</sub>) and chamber surface material (aluminum) maximize volatile compound or complex formation (e.g., SiF<sub>4</sub> or aluminum fluoride) when fluorine contacts the SiO<sub>2</sub> residue or the aluminum chamber surface, respectively. *See* col. 38, lns. 38 40 and lns. 43-46. Claims 2 and 6 are thus patentable over Frankel. Accordingly, allowance of claims 2 and 6 is respectfully requested.

#### ***Claims 3 and 4***

Claim 3 recites a combination of elements, including, for example:

...wherein the surface blocks an etching material.

Claim 4 recites a combination of elements, including, for example:

...wherein the blocked etching material is selected from the group consisting of fluorine, chlorine, oxygen, argon, bromine, fluorocarbons and chlorofluorocarbons.

Frankel also does not disclose these claimed features. Instead, Frankel discloses reacting fluorine gas with oxide residues formed on the interior surfaces of a reaction chamber to form volatile gases, such as  $\text{SiF}_4$ . *See* col. 38, lns. 38-40; col. 55, lns. 62-67. Additionally, Frankel discloses that its aluminum-surfaced chamber walls will not block an etching material such as fluorine gas. *See* col. 38, lns. 43-46. Instead, the etching material will contaminate and/or react with the aluminum to form a volatile aluminum fluoride compound or complex. *Id.* Thus, claims 3 and 4 are patentable over Frankel. Accordingly, allowance of claims 3 and 4 is respectfully requested.

***Claims 5 and 7***

Claim 5 recites a combination of elements, including, for example:

...wherein the substance binds with silicon and minimizes Si-F bonding.

Claim 7 recites a combination of elements, including, for example:

...wherein the substance minimizes  $\text{SiF}_4$  formation

Frankel does not disclose either of these claimed features. In fact, Frankel maximizes Si-F bonding by introducing fluorine gas to react with  $\text{SiO}_2$  to form  $\text{SiF}_4$  gas. *See* col. 38, lns. 38-40. Thus, Frankel teaches away from the elements of claims 5 and 7, which are thus patentable distinct over Frankel. Accordingly, allowance of claims 5 and 7 is respectfully requested.

***Claims 13 and 17***

Claim 13 recites a combination of elements, including, for example:

... incorporating a substance in the first material of the interior surface of the reactor chamber, the substance comprising a seasoning element or compound containing seasoning atoms or molecules that when combined with the chamber surface and/or a material to be used in the reactor chamber are relatively less volatile than a combination, alone without the seasoning atoms or molecules, of the chamber surface and the material to be used in the reactor chamber.

Frankel does not teach the features recited in claim 13.

In addition to the arguments presented for claim 1, which is incorporated herein, Appellants further argue that Frankel does not disclose or even remotely suggest the features of claim 13. For example, Frankel teaches away from the feature of “seasoning element .... When combined with the chamber surface and/or a material to be used in the reactor chamber are relatively less volatile than a combination, alone without the seasoning atoms or molecules, of the chamber surface and the material to be used in the reactor chamber.”

Frankel, on the other hand, merely describes a gettering process to absorb fluorine from the surface of the chamber walls. *See* col. 56, ll. 43-45. That is, Frankel seasons a reaction chamber to trap fluorine atoms that may have been adsorbed (collected in a condensed form) onto the surfaces of the chamber. *See* col. 57, ll. 20-25. In one embodiment, gases, such as hydrogen and ammonia are used to season the chamber. The hydrogen reacts with the adsorbed fluorine to produce hydrogen fluoride (Hf) vapor, which may be pumped out of the chamber. *See* col. 59, lns. 48-51. The ammonia reacts with the adsorbed fluorine to produce an ammonium fluoride compound and Hf vapor which may then be pumped out of the chamber. *See* col. 60, lns. 5-8.

The Examiner is of the opinion that Frankel shows seasoning identical to that claimed by Appellants. Instead, Frankel's seasoning reacts gas with adsorbed fluorine atoms to maximize the formation of volatile compounds which are then aspirated away. Therefore, it is Appellants' position that Frankel's seasoning (e.g., gettering process) is not the seasoning claimed by Appellants. In contrast to the teachings of Frankel, the seasoning of the claimed invention incorporates into the chamber walls atoms or molecules of a substance that minimizes adsorption of fluorine atoms by bonding with an etchant material such as fluorine gas, to form a relatively non-volatile compound or complex. *See Specification, p.10, lns. 13-16.* This non-volatile compound or complex is less volatile than a compound or complex formed by the reaction formed between the material that forms the interior surface of the reactor chamber and the etchant. *Id.* at p. 9, lns. 8-11. Because nothing in Frankel teaches its features, claim 13 is patentable over Frankel. Claim 17 is also patentable over Frankel based on its dependency from allowable base claim 13. Accordingly, allowance of claims 13 and 17 is respectfully requested.

***Claim 14***

Claim 14 recites a combination of elements, including, for example:

... the step of incorporating a substance includes placing the seasoning element or compound in solid form in the reaction chamber

Frankel does not disclose this claimed feature. In contrast, Frankel discloses using ozone, helium, hydrogen, silane, ammonia and other gases to react with fluorine left over from a processing operation and adsorbed onto the chamber walls. *See col. 57, lns. 20-25; col.*

59, lns. 48-51; col. 59, lns. 55-57. There simply is no disclosure of using a solid compound or seasoning atom. Thus, claim 14 is patentable over Frankel. Accordingly, allowance of claim 14 is respectfully requested.

***Claim 16***

Claim 16 recites a combination of elements, including, for example:

... the seasoning element or compound is selected from the group consisting of cobalt-based elements or compounds, aluminum-based elements or compounds, copper-based elements or compounds, titanium-based elements or compounds and silicon-based elements or compounds.

Thus, in one embodiment of the claimed invention, (cobalt is incorporated into the first material (e.g., Si) that forms the interior surface of the reactor chamber. *See* Specification, p. 9, ln. 1 to p. 10, ln. 34. The cobalt atoms or molecules when combined with an etching material, such as fluorine, (e.g., a material to be used in the reactor chamber) are relatively less volatile than a combination of the silicon that forms the chamber surface and the etching material. *Id.* at p. 10, lns. 11-19.

Additionally, in Frankel discloses the seasoning element or compounds recited in claim 16. Instead, Frankel discloses using ozone, helium, hydrogen, silane, ammonia and other gases to react with fluorine left over from a processing operation and adsorbed onto the chamber walls. *See* col. 57, lns. 20-25; col. 59, lns. 48-51; col. 59, lns. 55-57. Because Frankel does not disclose a seasoning element or compound as claimed, claim 16 is patentable over Frankel. Accordingly, allowance of claim 16 is respectfully requested.

***Claims 18, 22, and 23***

Claim 18 recites a combination of elements, including, for example:

....incorporating a substance in the first material of the interior surface of the reactor to minimize an undesirable reaction at the surface and prime the reactor.

Frankel does not teach at least this feature. Appellants' specification discloses that a substance, such as, but not limited to, cobalt, is implanted in a material that forms an interior surface of reactor, and that the implanted substance primes the reactor and minimizes the formation of  $\text{SiF}_4$  (an undesirable reaction). *See* Specification, p. 5, lns. 21-25; p. 9, lns. 27-34. Incorporation of a substance in the first material minimizes the undesirable reaction at the surface (e.g., silicon) by providing alternative atoms (e.g., cobalt) that easily bond with fluorine to form cobalt fluoride, a non-volatile compound. *Id.* at p. 10, lns. 21-34.

In contrast, Frankel prevents fluorine from contaminating or reacting with the aluminum walls of the chamber by closing a valve at the precise moment when substantially all of an oxide residue that coats the interior chamber surfaces is consumed. *See* col. 38, lns. 47-51.

Clearly the detection system of Frankel operates by measuring the amount of  $\text{SiO}_2$  residue left on the chamber walls and the rate at which it is consumed by the fluorine gas. However, neither of these teachings incorporate a substance into the chamber walls to minimize an undesirable reaction as claimed. This is a reaction which is avoided in the claimed invention. Thus, claim 18 is patentable over Frankel. Claims 22 and 23 are also patentable over Frankel based on their dependencies from allowable base claim 18. Accordingly, allowance of claims 18, 22, and 23 is respectfully requested.

***Claims 19 and 20***

Claim 19 recites in pertinent part:

... the undesirable reaction is formation of a volatile compound or complex.

Claim 20 recites in pertinent part:

... the undesirable reaction is formation of SiF<sub>4</sub>.

Frankel does not teach the features recited in dependent claims 19 and 20, each of which depend from allowable base claim 18. As noted above, claim 18 recites minimizing an undesirable reaction. Specifically, in direct contrast to claims 19 and 20, Frankel expressly teaches maximizing the formation of SiF<sub>4</sub>, which, as previously shown, is a volatile compound or complex. *See* col. 38, lns. 35-35. Thus, claims 19 and 20 are patentable over Frankel. Accordingly, allowance of claims 19 and 20 is respectfully requested.

***Claims 24-26***

Claim 24 recites a combination of elements including, for example:

.... incorporating a substance in a first material of an interior surface of the reaction chamber, the substance comprising seasoning atoms or molecules that reduce the formation of volatile compounds and complexes when fluorine encounters the surface; ...

Frankel teaches none of these features.

As mentioned above, Frankel does not teach seasoning atoms incorporated into a first material of an interior surface of the reaction chamber. Instead, Frankel discloses determining when an endpoint of a cleaning process has occurred, as well as stopping the introduction of fluorine gas to a chamber and discharging the gas residue in response to

detection of the endpoint. *See* col. 38, lns. 25-34. These elements differ from the claimed features, and in fact teach away from them. Thus, claim 24 is patentable over Frankel. Claims 25-26 are also patentable over Frankel based on their dependencies from allowable base claim 24. Accordingly, allowance of claims 24-26 is respectfully requested.

***REJECTION UNDER 35 U.S.C. 103(a)  
OF CLAIM 8***

Claim 8 recites in pertinent part:

... the chamber comprises silicon or silicon carbide.

The Examiner admits that nothing in Frankel discloses this feature, but cites Han (U.S. Patent No.: 6,508,911) as curing Frankel's deficiency. In contrast to the claimed invention, however, Han discloses a reaction chamber having a silicon-based material which is coated with diamond to resist etching. *See* Figure 6; col. 6, ln. 66 to col. 7, ln. 2; and col. 8, lns. 22-28. The diamond coating is formed to a thickness of about 40-60  $\mu\text{m}$  to provide a coating lifetime of about 4000 hours of etching time. *See* col. 7, lns. 61-63. Han teaches adding the diamond coating to extend the operating lifetime of the reactor, because a reactor having interior surfaces formed primarily of silicon or silicon carbide as claimed, would experience significant damage during chlorine-based etching. Because Han teaches away from using un-coated silicon and silicon carbide as materials in a reactor, it does not disclose the features of claim 8. Therefore, claim 8 is allowable over Frankel and Han, whether alone, or in combination, for its own features as well as for its

dependency on allowable base claim 1. Accordingly, allowance of claim 8 is respectfully requested.

***REJECTION UNDER 35 U.S.C. 103(a)  
OF CLAIMS 10, 12, 15 AND 21***

***Claims 10 and 21***

Claim 10 recites, in pertinent part:

... the chamber surface includes cobalt-silicon bonds and/or cobalt-fluorine bonds.

Claim 21 recites, in pertinent part:

... after the step of incorporating the substance, the interior surface includes Si-Co and/or Co-F bonds.

The Examiner admits Frankel does not teach the features of claims 10 and 21, but cites Radhamohan (U.S. Patent No. 5,997,685) as curing Frankel's deficiencies. Appellants respectfully traverse this rejection.

Radhamohan discloses fabricating components of a corrosion resistant apparatus from an alloy comprising nickel and an eutectic component. *See* col. 2, lns. 57-60. The term "eutectic component" means an additive or mixture of additives that form an eutectic system with nickel that has a melting temperature that is substantially lower than that of pure nickel. *See* col. 5, lns. 51-54. Preferred eutectic components are beryllium, chromium, and mixtures thereof. *See* col. 5, lns. 57-58. The alloy can also comprise small amounts, typically less than 2 wt % of additional elements, such as cobalt, carbon, molybdenum, or mixtures thereof, to provide increased corrosion resistance, thermal shock resistance, or to improve other properties of the alloy. *See* col. 6, lns. 9-14.

Whereas the claimed invention incorporates a substance, such as cobalt, into a chamber surface to balance receipt of a to-be controlled material, such as SiF<sub>4</sub>, Radhamohan oppositely teaches that eutectic components are added to the nickel “to lower the melting point of the nickel alloy to provide increased fluidity at relatively low melting temperatures, and to allow ease of fabrication of components having complex geometries” (col. 5, lns. 46-51). Additional elements such as cobalt, carbon, molybdenum, or mixtures thereof may optionally be added later to improve various characteristics of the nickel alloy.

Thus, neither Frankel nor Radhamohan, alone or in combination, teach or suggest a chamber surface having a substance incorporated therein to balance receipt of a to-be controlled substance, wherein the substance includes cobalt-silicon bonds and/or cobalt-fluorine bonds, as recited in claims 10 and 21.

### ***Claim 12***

Claim 12 recites that the chamber surface includes at least about 8 atom % cobalt. In direct contrast, Radhamohan specifically teaches that its nickel alloy may optionally contain “typically less than 2 weight %, of additional elements, such as cobalt, carbon, molybdenum, or mixtures thereof to provide increased corrosion resistance, thermal shock resistance, or to improve other properties of the alloy” (col. 6, lns. 10-14). This is contrary the claimed phrase “at least about 8 atom % cobalt”, which is an open-ended limitation that far exceeds any amounts of cobalt contemplated by Radhamohan.

Additionally, Radhamohan discloses such a small amount of cobalt because nickel itself is very corrosion resistant. The larger amounts of cobalt recited in claim 12

are preferred because the material forming the components of the chamber is usually less-resistant to corrosion than the nickel disclosed by Radhamohan.

For these reasons, claim 12 recites limitations that are not disclosed by either Frankel or Radhamohan, alone or in combination. Thus, claim 12 is patentable over the combination of Frankel and Radhamohan. Accordingly, allowance of claim 12 is respectfully requested.

***Claim 15***

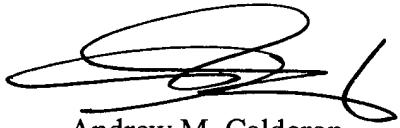
Dependent claim 15 recites placing a cobalt-containing solid in the chamber. This is done to incorporate cobalt into the material. *See* Specification, p. 9, lns. 16-17. The Examiner admits Frankel does not teach this feature, but suggests that Radhamohan cures this deficiency. Radhamohan, however, does not disclose placing a cobalt-containing solid in the chamber to incorporate cobalt into the material that forms the chamber walls. Instead, Radhamohan discloses fusing elements, such as nickel and cobalt, together into a liquid mixture which is cast in molds to form components that are later assembled into various types of apparatus, such as a reactor chamber. *See* col. 5, lns 46-64; and col. 6, lns. 47-67 to col. 7, lns. 1-16. Clearly, if the teachings of Radhamohan and Frankel were combined, they would not disclose or suggest placing a cobalt-containing solid in the chamber, as recited by claim 15. Instead they would disclose using SiF<sub>4</sub> gas to clean a silicon oxide residue from the nickel-alloy walls of a reactor chamber.

Thus, claim 15 is patentable over the combination of Frankel and Radhamohan. Accordingly, allowance of claim 15 is respectfully requested.

## CONCLUSION

In summary, neither Frankel alone nor the combination of Frankel and Ramhamohan or Frankel and Han teach or suggest the features of the claimed invention. Therefore, the references do not provide evidence that would support a conclusion of anticipation under 35 U.S.C. §102(e) or a conclusion of obviousness under 35 U.S.C. §103(a). Appellants thus respectfully submit that the rejections of claims 1-26 are in error and that reversal is warranted in this case.

Respectfully submitted,



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## CLAIMS APPENDIX

A copy of the claims involved in the appeal is provided below.

1. A semiconductor production reactor comprising at least one interior chamber surface, the at least one interior chamber surface comprising a first material and a substance incorporated in the first material, the substance balances receipt of a to-be-controlled material.
2. The reactor of claim 1, wherein the interior chamber surface minimizes volatile compound or complex formation upon a to-be-controlled material contacting the interior chamber surface.
3. The reactor of claim 1, wherein the surface blocks an etching material.
4. The reactor of claim 3, wherein the blocked etching material is selected from the group consisting of fluorine, chlorine, oxygen, argon, bromine, fluorocarbons and chlorofluorocarbons.
5. The chamber of claim 1, wherein the substance binds with silicon and minimizes Si-F bonding.
6. The chamber of claim 1, wherein the substance minimizes formation of a volatile compound or complex.
7. The chamber of claim 1, wherein the substance minimizes  $\text{SiF}_4$  formation.
8. The chamber of claim 1, wherein the chamber comprises silicon or silicon carbide.

9. The chamber of claim 1, wherein the substance impedes reaction between the chamber surface and the to-be-controlled material.

10. The chamber of claim 1, wherein the chamber surface includes cobalt-silicon bonds and/or cobalt-fluorine bonds.

11. The chamber of claim 1, comprising a cleaned and substance-containing chamber surface.

12. The chamber of claim 1, including at least about 8 atom % cobalt in the at least one interior chamber surface.

13. A method of seasoning a reactor chamber, comprising at least the steps of: providing a reactor chamber having at least one interior surface, the at least one interior surface comprising a first material; incorporating a substance in the first material of the interior surface of the reactor chamber, the substance comprising a seasoning element or compound containing seasoning atoms or molecules that when combined with the chamber surface and/or a material to be used in the reactor chamber are relatively less volatile than a combination, alone without the seasoning atoms or molecules, of the chamber surface and the material to be used in the reactor chamber.

14. The method of claim 13, wherein the step of incorporating a substance includes placing the seasoning element or compound in solid form in the reaction chamber.

15. The method of claim 13, wherein a cobalt-containing solid is placed in the chamber.

16. The method of claim 13, wherein the seasoning element or compound is selected from the group consisting of cobalt-based elements or compounds, aluminum-

based elements or compounds, copper-based elements or compounds, titanium-based elements or compounds and silicon-based elements or compounds.

17. The seasoning method of claim 13, including periodic cleaning of the chamber.

18. An etching method, comprising:  
providing a reactor chamber having at least one interior surface comprising a first material;  
incorporating a substance in the first material of the interior surface of the reactor to minimize an undesirable reaction at the surface and to prime the reactor; and  
producing an etched product in the primed reactor chamber.

19. The etching method of claim 18, wherein the undesirable reaction is formation of a volatile compound or complex.

20. The etching method of claim 18, wherein the undesirable reaction is formation of  $\text{SiF}_4$ .

21. The method of claim 18, wherein after the step of incorporating the substance, the interior surface includes Si-Co and/or Co-F bonds.

22. The method of claim 18, including producing an oxide or oxynitride film or etching via holes.

23. The method of claim 18, including periodically cleaning the chamber.

24. A method of controlling fluorine in production processes in a reactor, comprising at least the steps of:

incorporating a substance in a first material of an interior surface of the reaction chamber, the substance comprising seasoning atoms or molecules that reduce the

formation of volatile compounds and complexes when fluorine encounters the surface;  
and

conducting a production process in the reactor in which fluorine is present in the  
reaction chamber.

25. The method of claim 24, wherein the production process includes etching.

26. The method of claim 24, further including periodic cleaning of the  
reaction chamber.

## **EVIDENCE APPENDIX**

This section lists evidence submitted pursuant to 35 U.S.C. §§1.130, 1.131, or 1.132, or any other evidence entered by the Examiner and relied upon by Appellant in this appeal, and provides for each piece of evidence a brief statement setting forth where in the record that evidence was entered by the Examiner. Copies of each piece of evidence are provided as required by 35 U.S.C. §41.37(c)(ix).

<b>NO.</b>	<b>EVIDENCE</b>	<b>BRIEF STATEMENT SETTING FORTH WHERE IN THE RECORD THE EVIDENCE WAS ENTERED BY THE EXAMINER</b>
1	N/A	N/A

**RELATED PROCEEDINGS APPENDIX**

Pursuant to 35 U.S.C. §41.37(c)(x), copies of the following decisions rendered by a court of the Board in any proceeding identified above under 35 U.S.C. §41.37(c)(1)(ii) are enclosed herewith.

<b>NO.</b>	<b>TYPE OF PROCEEDING</b>	<b>REFERENCE NO.</b>	<b>DATE</b>
1	N/A	N/A	N/A

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